4.2. Transmission Reassembly

⚠ CAUTION Safety glasses are required.

4.2.1. Gear Case

Prepare the gear case for assembly by running a tap through all bolt and screw holes. Cleaning the threads ensures there is no damage and enables you to determine if the gear case has standard or metric threads. It also enables you to determine the proper tooling to use in the assembly process.

Before beginning the assembly of the drive unit, record the bearing seat data stamped on the gear case. Record the setting distance information stamped on the bevel and spiral gears. This data will be used in the formula to determine shim thickness.

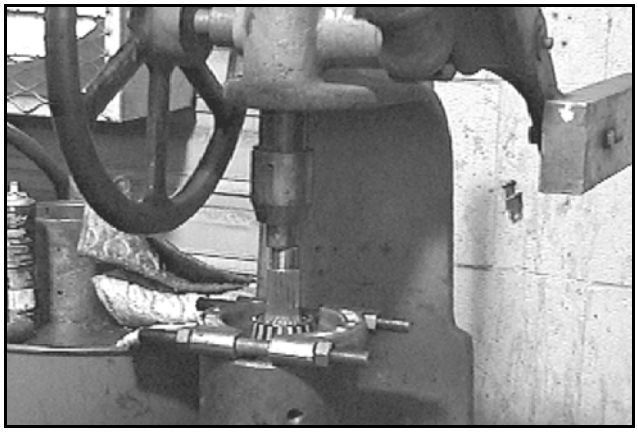
Cleaning and Inspection

Thoroughly degrease the gear case. Visually inspect the entire gear case again for excessive damage, cracks or wear.

4.2.2. Axle Shaft

Installation

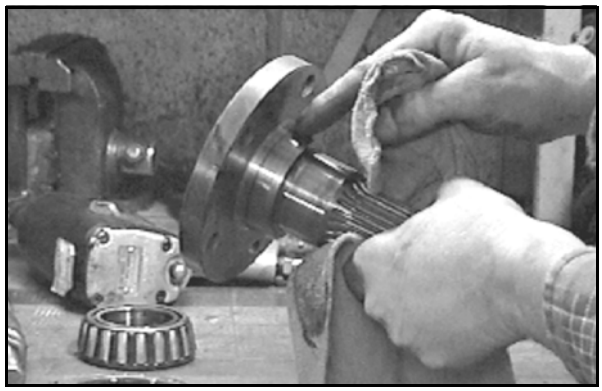
1. Place a bearing puller clamp between the axle seal and beneath the axle bearing cone.



CAUTION Always watch for pinch points when using a press or pressing tools.

2. Press the bearing from the axle using a bearing press and a 6 inch (152 mm) tube.

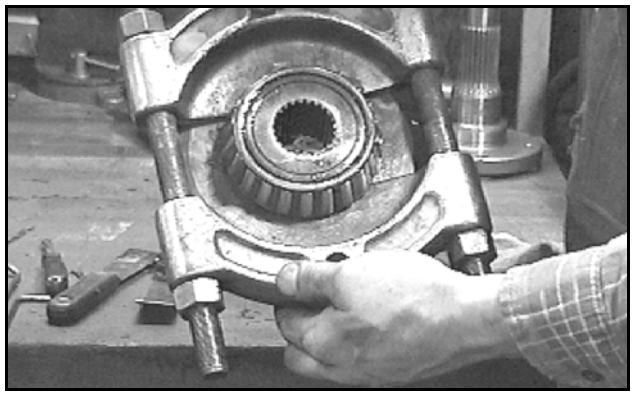
3. Lift axle seal from the axle.



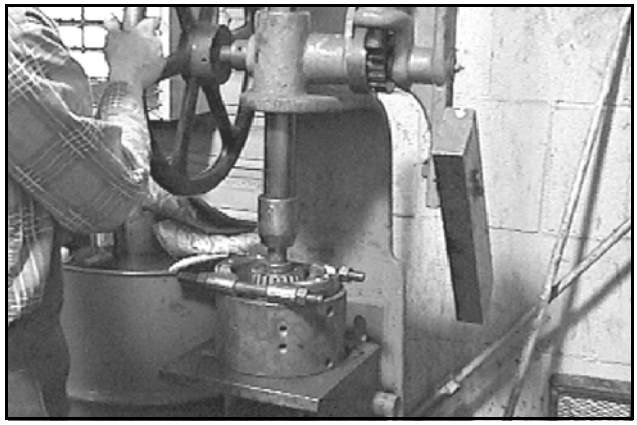
4. Inspect the axle for damage or wear.

4.2.3. Bevel Gear

Installation



1. Place the bearing puller clamp on the bevel gear beneath the bearing.

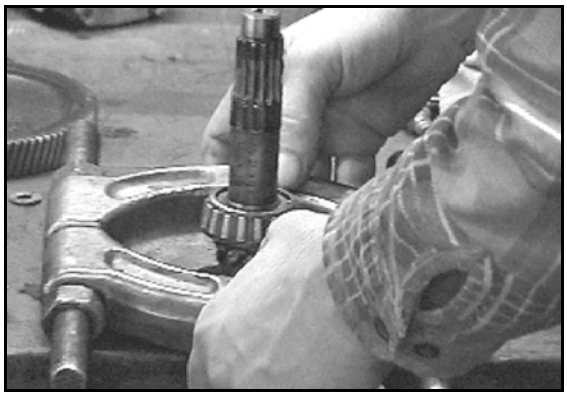


CAUTION Always watch for pinch points when using a press or pressing tools.

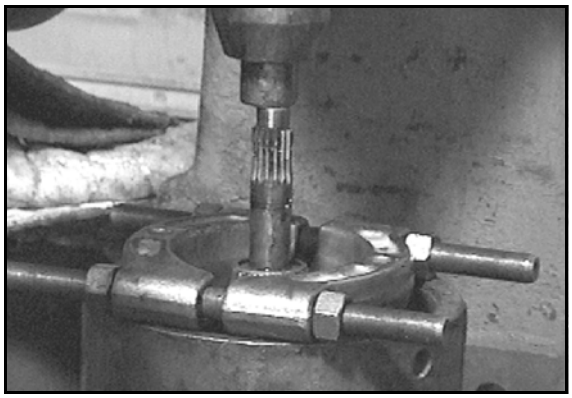
2. Press the bearing from the bevel gear using a bearing press and an 8 inch (203 mm) tube.

4.2.4. Spiral Gear

Installation



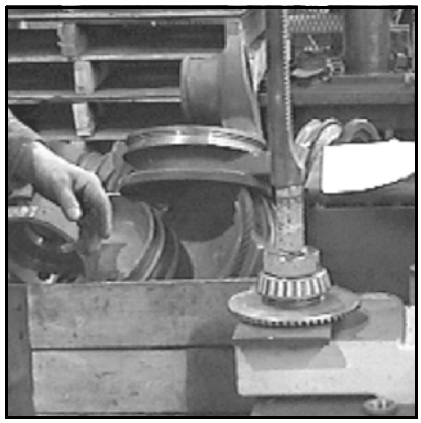
1. Place a bearing puller clamp beneath the bearing cone on the spiral gear.



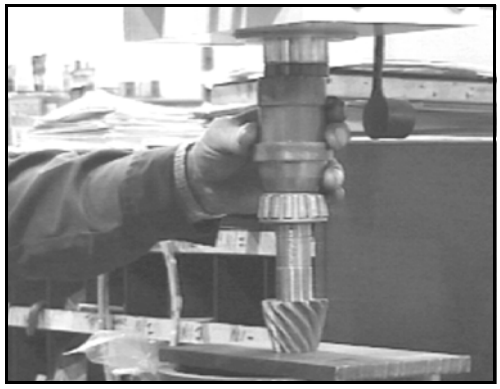
CAUTION Always watch for pinch points when using a press or pressing tools.

2. Press the bearing from the spiral gear using a bearing press.

4.2.1. Gear Set



1. Press the bearing cone (7) on the bevel gear (10) until it is seated. Place the matching bearing cup on the bearing cone for measuring purposes.

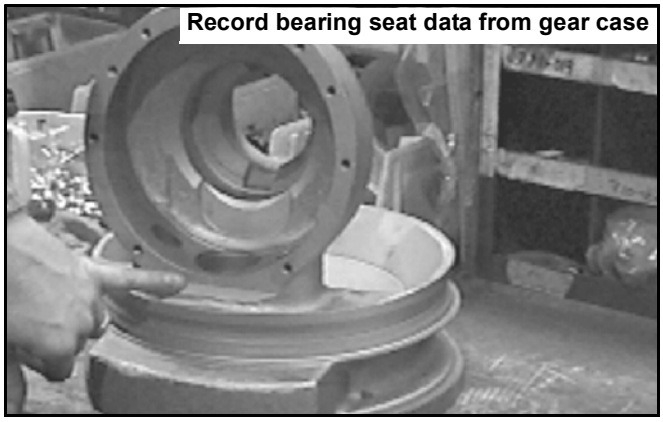


CAUTION Always watch for pinch points when using a press or pressing tools.

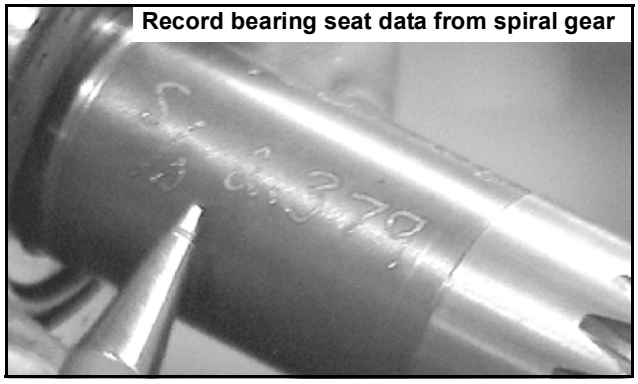
2. Press the bearing cone (6) on the spiral gear (3) until it is seated. Place the matching bearing cup on the bearing cone for measuring purposes.
3. Use the bearing zero offset tool and the following formulas to determine the shim thickness that will be required to assemble the gear set in the gear case.

4.2.2. Calculating Shim Formulas

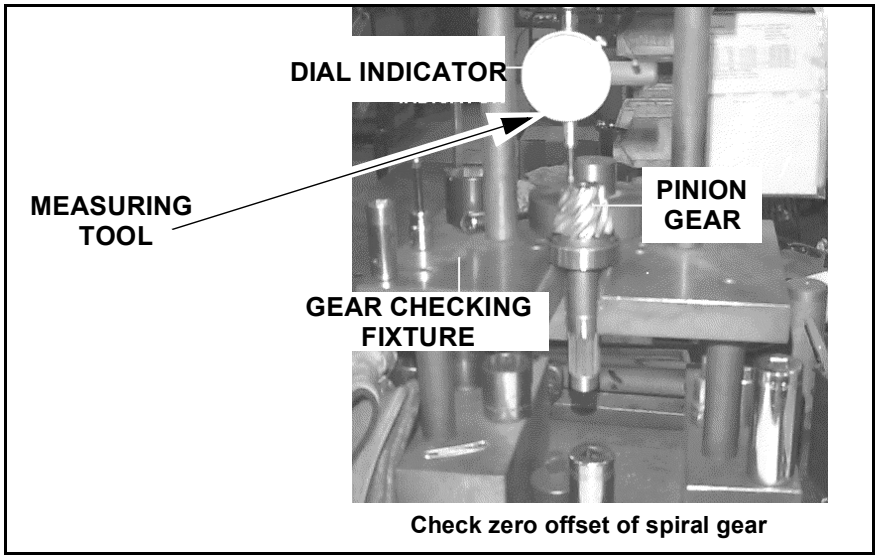
Spiral pinion gear shim



- A = Dimension A stamped on gear case (4.438 inches [113 mm])



- B = Number etched on gear (S/D 2.378 inches [60 mm])



- C = Zero Offset

Use measuring tool (see page 165) to determine the zero offset. Place the plug on the tool and zero out the dial indicator. Place the spiral gear in the tool, shaft end down. Turn the spiral gear as if seating the bearings. Record the data from the dial indicator to use in the formula.

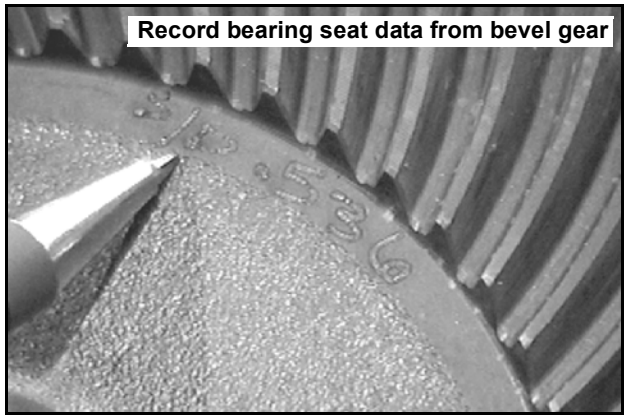
- D = Plug Height (2.025 inches [51 mm])
- E = B + C + D
- F = A - E

  F = Shim thickness required

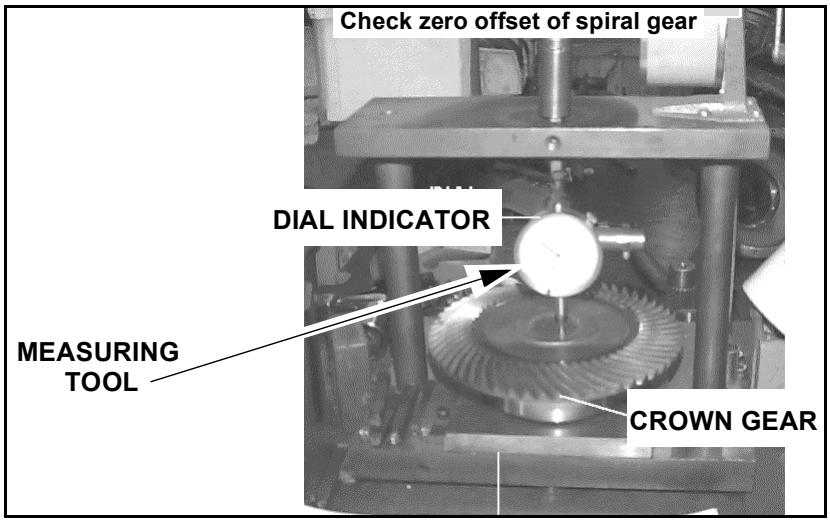
This calculation is used to determine the shim amount behind the bearing cup in the main gear case. The shim(s) position(s) the spiral gear for proper backlash.

Bevel gear shim

- G = Dimension B stamped on gear case (2.506 inches [64 mm])



- H = Number etched on gear (S/D 0.541 inches [14 mm])



- J = Zero Offset

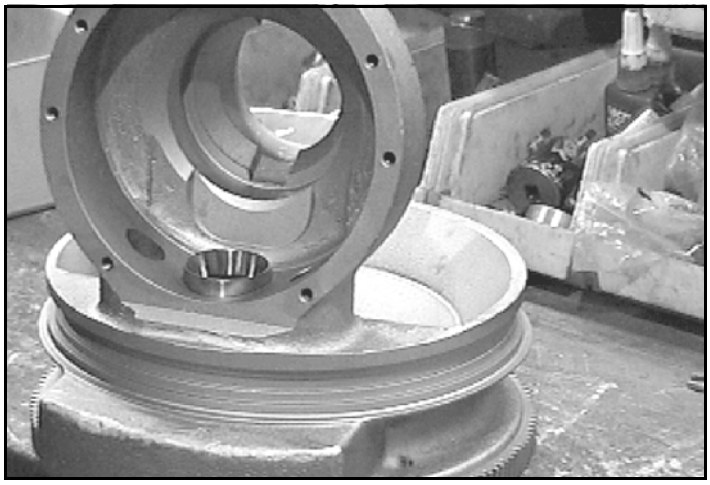
  Use measuring tool to determine the zero offset. Place the plug on the tool and zero out the dial indicator. Place the bevel gear on the tool, race side down. Turn the bevel gear as if seating the bearings. Record the data from the dial indicator to use in the formula.

- K = Plug height (1.875 inches [48 mm])
- L = H + J + K
- M = G - L

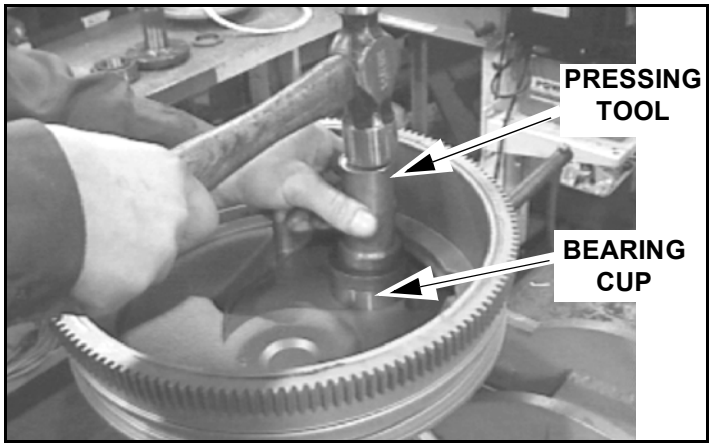
  M = Shim thickness required

This calculation is used to determine the shim amount behind the bearing cup in the main gear case. The shim(s) position(s) the bevel gear for proper backlash.

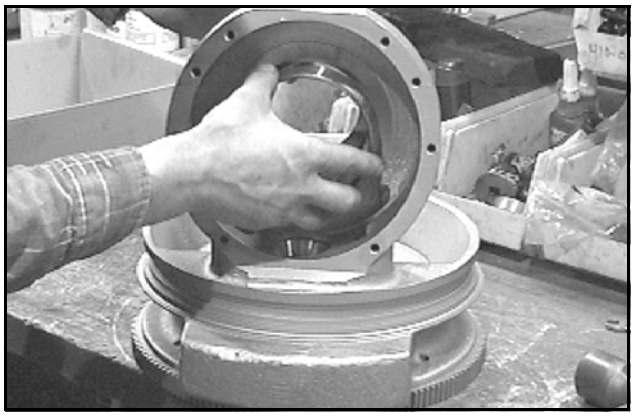
4.2.3. Gear Case Bearing Cup and Shim



1. Place the spiral gear shims in the gear case, then place the bearing cup in the gear case.

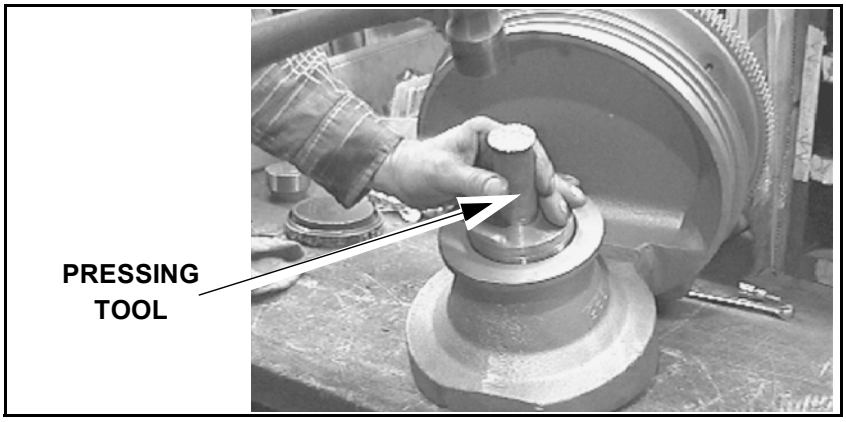


2. Place pressing tool on the spiral gear bearing cup (8). Using a press or mallet, install the bearing cup into the gear case bore.

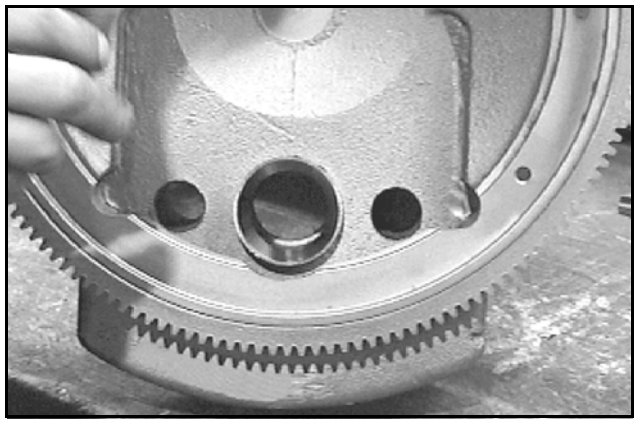


3. Place bevel gear shim in the gear case, followed by the bearing cup. Use pressing tool with a press or mallet to press the bearing cup into the gear case bore.

NOTE! Be sure to wipe away any chips or excess metal pieces resulting from driving the race to seat it.



4. Place the drive axle bearing cup in the gear case. Use pressing tool and a mallet or press to seat the axle bearing cup in the gear case.



5. Turn the drive unit gear case over. Install the helical bearing cup in the gear case. Use pressing tool and a press or mallet to seat the bearing cup in the gear case.

4.2.4. Helical Gear/Spiral Pinion Gear

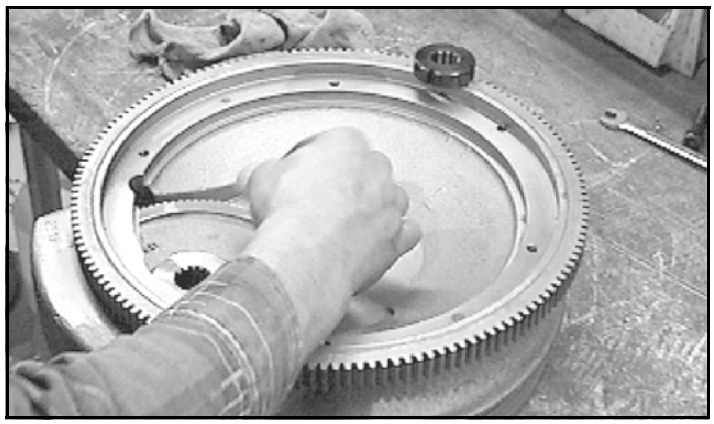
⚠ **WARNING**	Bearing can become extremely hot. Use gloves to protect hands from burns.

NOTE!	The pinion shaft and bevel gear are a matched set. Their alignment is critical. Do not replace separately.

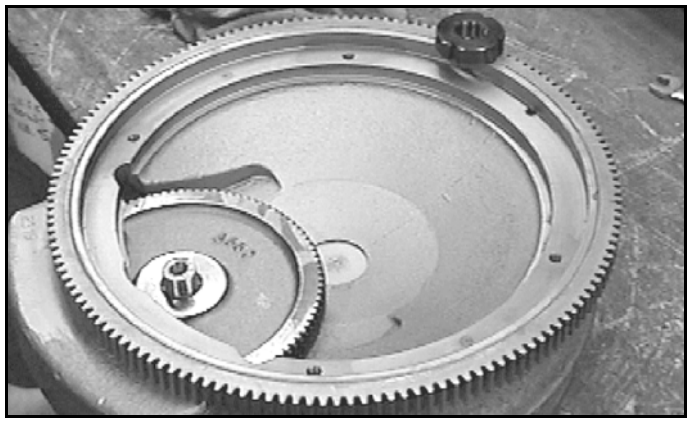
1. Preheat the bearing cone (6) with a bearing heater.

NOTE! Steps 2 through 5 need to be completed before the bearing cools to provide a proper installation.

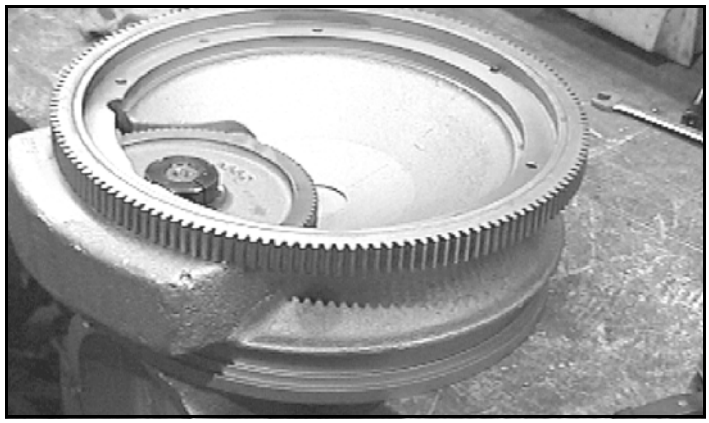
2. Install the heated bearing cone in the bearing cup in the gear case.



3. Place the spacer over the bearing cone, then place the helical gear (3) into the gear case.

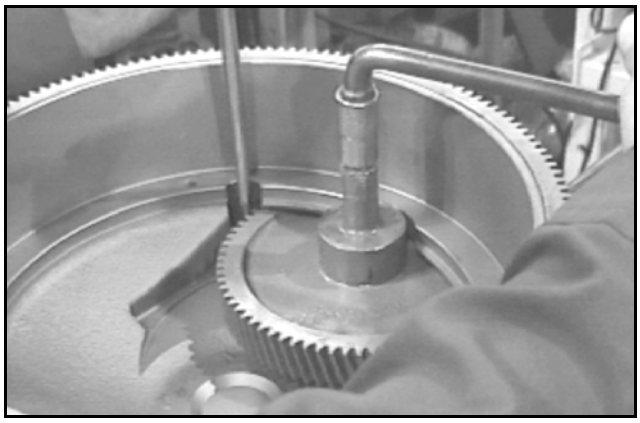


4. Install the spiral pinion (10) up through the helical gear (3). Push up until the spiral gear bearing is seated against its race.

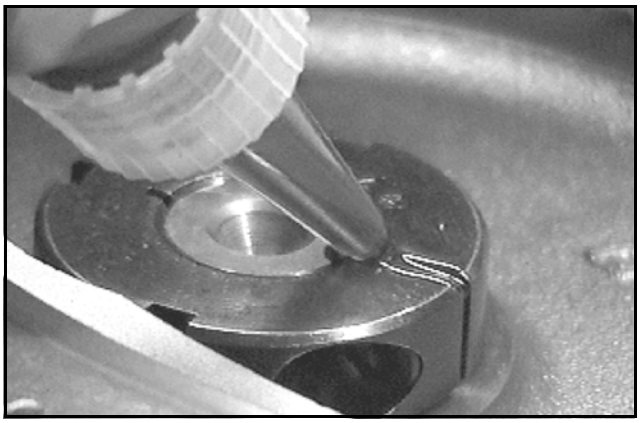


NOTE! Steps 2 through 5 need to be completed before the bearing cools to provide a proper installation.

5. Place the clamp nut (4) on the end of the spiral pinion and hand tighten until the bearing cools.

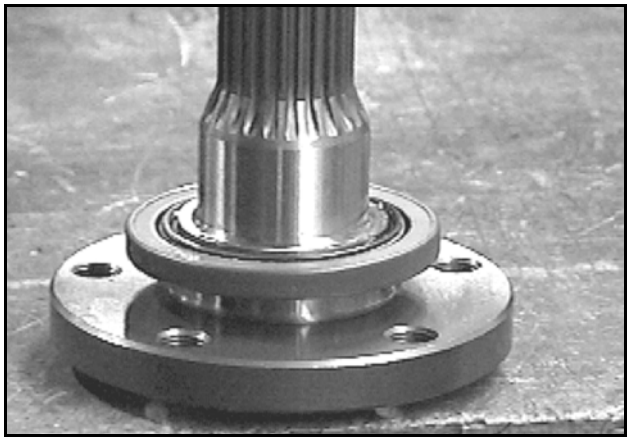


6. When the bearing has cooled, spin the helical gear to check for end play. Remove any end play in the bearings between the helical gear (3) and the spiral gear (10) using a nut driver tool and a wedge. Slowly tighten the clamp nut (4) on the end of the spiral gear until there is no end play between the gears. Use a spin and tighten method to tighten clamp nut (4) as the bearings are seating in the races.
7. Tighten clamp nut (4) the distance of a spanner nut space to preload the gears. Back the nut off, then hand tighten.

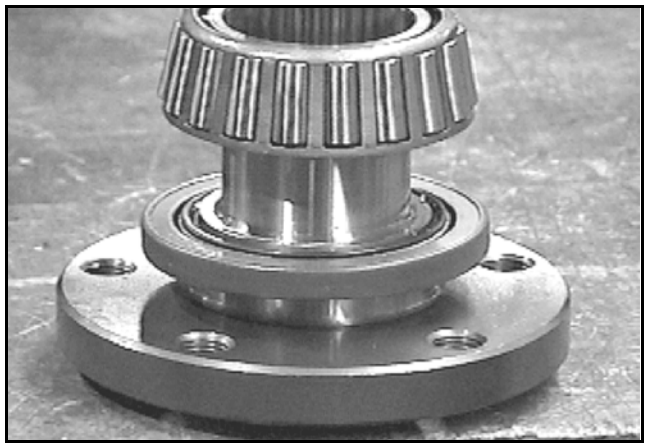


8. Apply Red Loctite 271® to the setscrew in the clamp nut. Torque setscrew to 70 in-lbs (8 N•m).
9. Spin the helical gear to be sure there is no end play or that the bearings are not too tight.

4.2.5. Axle



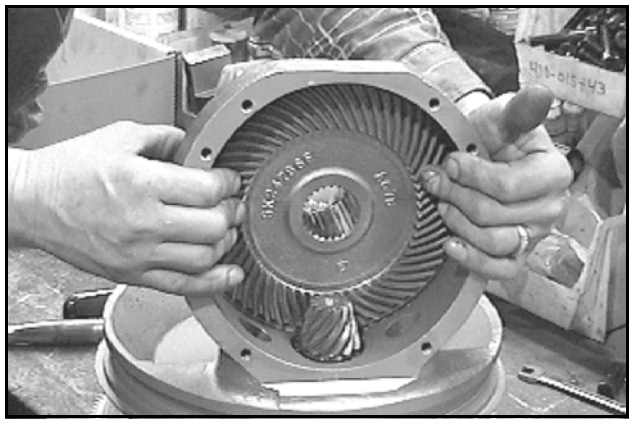
1. Lubricate the oil seal. Place the seal over the axle shaft with the spring side toward the oil.



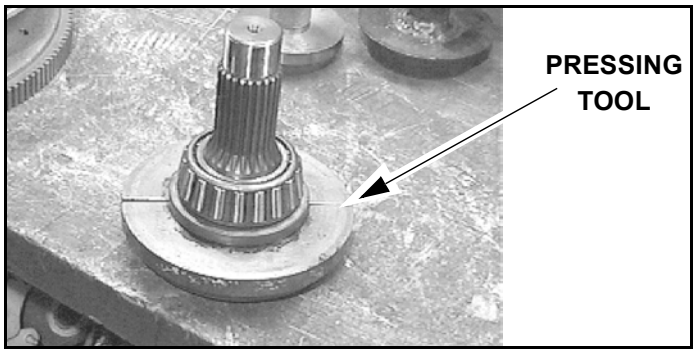
CAUTION Always watch for pinch points when using a press or pressing tools.

2. Place the axle bearing cone over the axle shaft. Press the bearing cone on the axle shaft until it is seated.

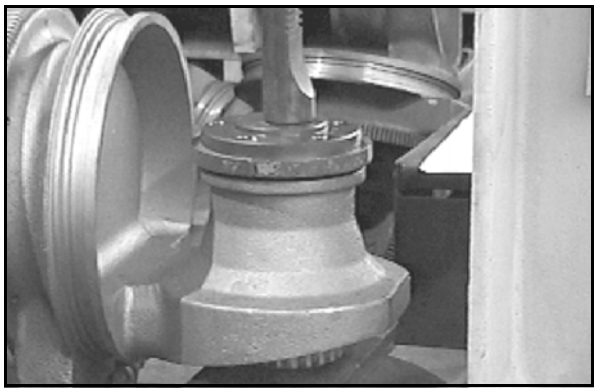
3. Apply a thin layer of gasket compound to the gear case to seal the axle seal.



4. Place the bevel gear into the gear case.



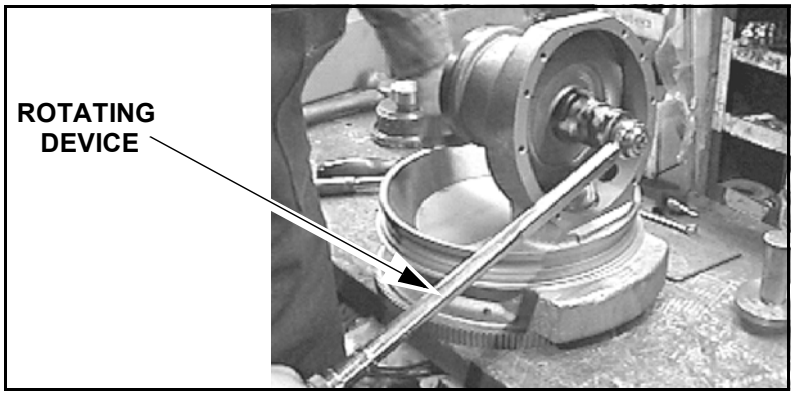
5. Place pressing tool beneath the axle seal. Install the axle shaft through the bevel gear.



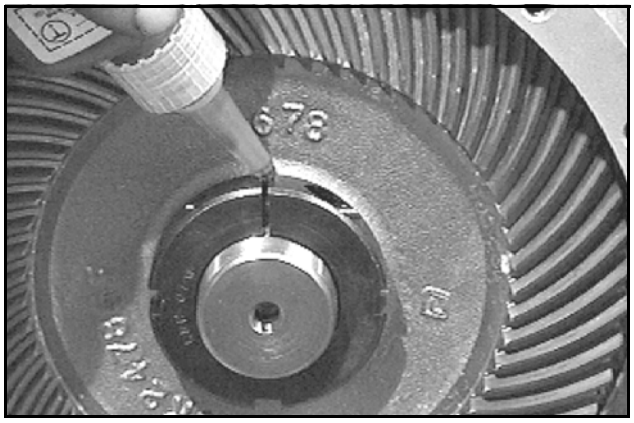
CAUTION Always watch for pinch points when using a press or pressing tools.

6. Press the axle into the gear case until the seal is fully installed.

7. Remove the seal driver tool.
8. Apply Red Loctite 271® to the threads of the axle.
9. Install the clamp nut (13). Hold the axle to keep it from turning as the clamp nut is tightened. Torque the clamp nut to 18 ft-lbs (24 N•m).

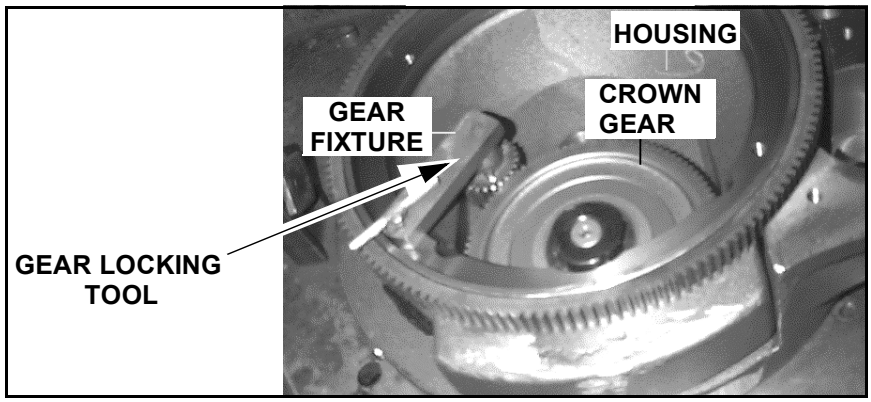


10. Install a rotating device on the end of the axle.
11. Rotate the axle and tighten the clamp nut. Repeat this step six times to be sure the bearing cones are seated into the cups.
12. Loosen the clamp nut, retighten to 5 ft-lbs (7 N•m) using the rotating device. Tighten until the clamp nut does not turn.



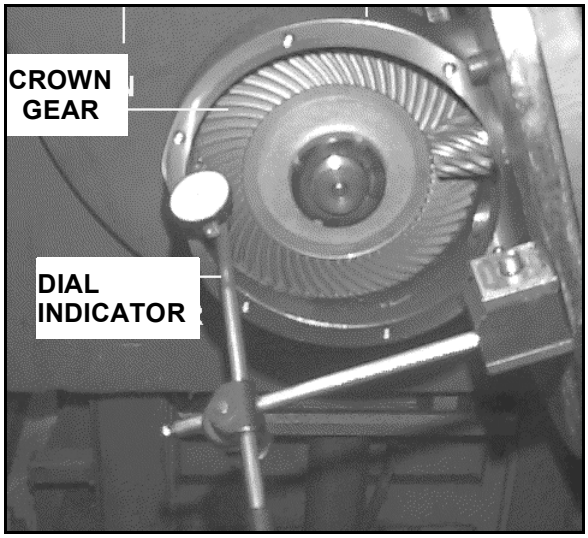
13. Apply Red Loctite 271® to the setscrew in the clamp nut. Torque the setscrew to 70 in-lbs (8 N•m).

4.2.6. Measuring Backlash

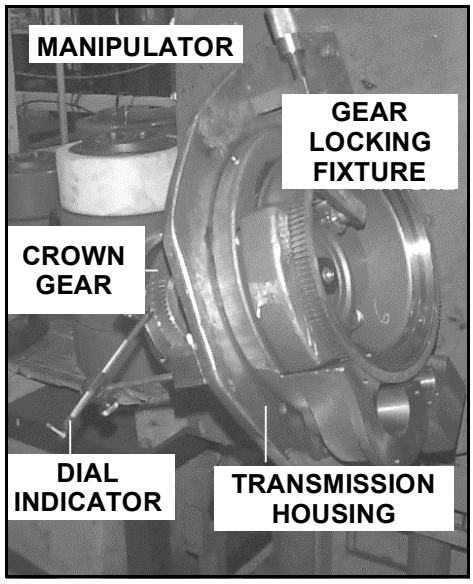


NOTE! Backlash tolerance is critical to the performance of the drive unit. Units adjusted improperly will cause premature failure.

1. Place the gear locking tool on the helical gear and secure.



2. Position probe of the dial indicator at the heel of the bevel gear tooth. The dial indicator probe should be perpendicular to the gear tooth surface.



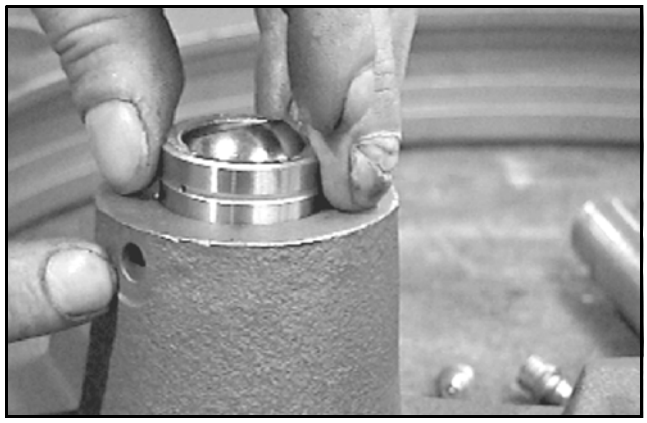
NOTE! Backlash tolerance is critical to the performance of the drive unit. Units adjusted improperly will cause premature failure.

3. Zero the indicator. Clasp the bottom of the gear and rotate it. Read the backlash measurement on the dial indicator. Total backlash tolerance is between 0.004 and 0.006 inch (0.1016 and 0.1524 mm).
4. If the tolerance is not within the acceptable limits, calculate necessary adjustments to the shims. Remove the clamp nut, axle assembly and bevel gear. Install the proper amount of shims, and repeat Steps 3 and 4 (see **"Gear Case Bearing Cup and Shim" on page 168**). Repeat steps 1 through 3 above until the backlash is between 0.004 and 0.006 inch (0.1016 and 0.1524 mm).
5. When backlash is within the acceptable range, install the pivot ring.

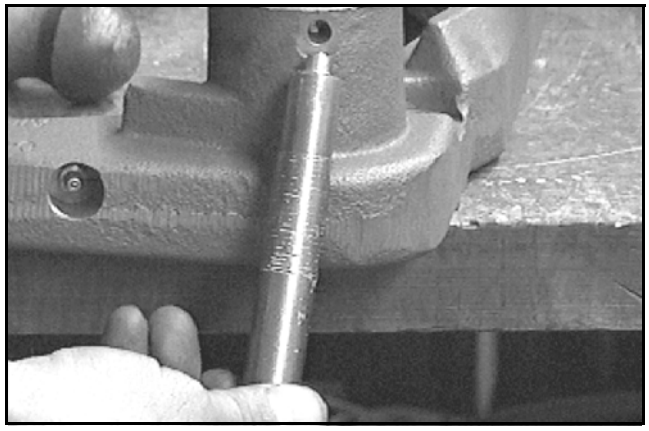
4.2.7. Pivot Ring

Assembly

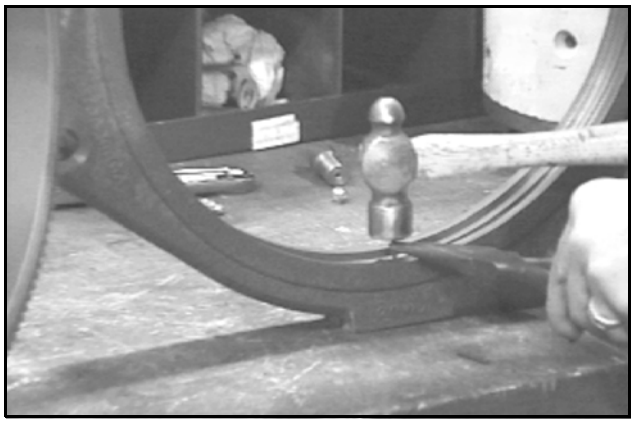
1. Place a light coating of Red Loctite 271® in the hole on the pivot ring assembly.



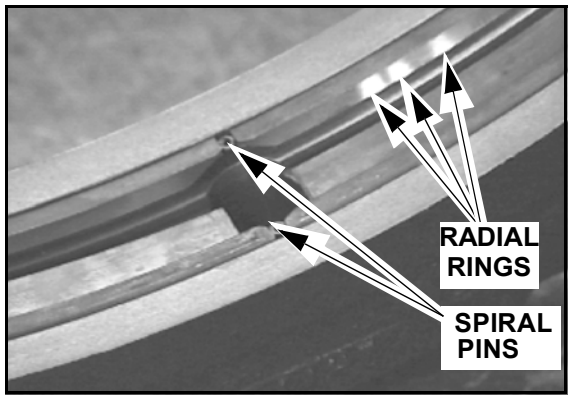
2. Line up the grease fitting hole with the grease fitting port.



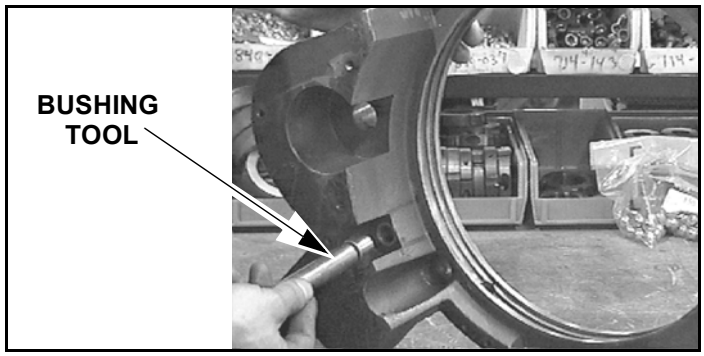
3. Install the grease fitting (30) in the pivot ring (27) assembly using a grease fitting driver and a mallet or press.



4. On the inside of the pivot ring (27), be sure the spiral pins (29) are installed and in good condition on either side of the bearing filler plug hole. Install new spiral pins if they are missing or damaged.



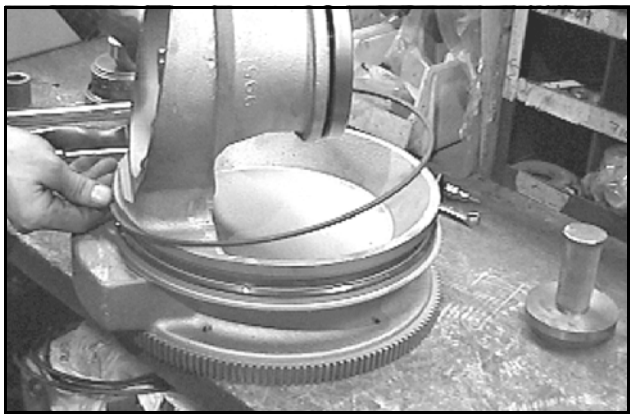
5. Install the radial rings (25) so that the gap aligns with the bearing hole. Install the flat radial ring on the inside flat surface of the pivot ring. Install chamfered radial rings to the pivot ring. The chamfered edges will face the steel balls. The ends of the radial ring will be against the spiral pins (29).



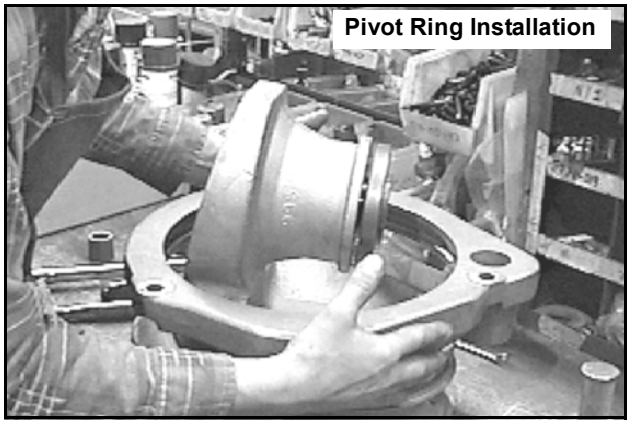
6. Install the brass bushing using tool and a mallet or press.

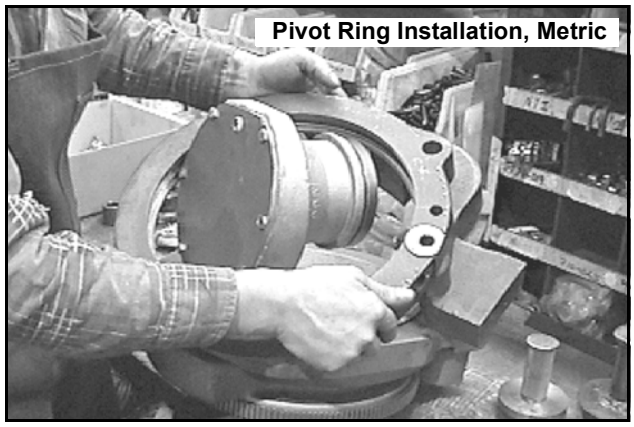
4.2.8. Drive Unit

Assembly

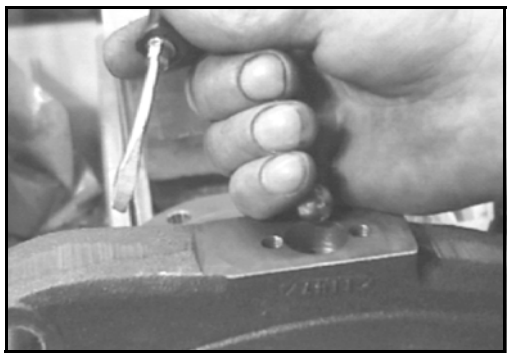


1. Install the radial rings (5) on the gear case. Stagger the ends of the rings around the gear case so the gaps are not aligned. The beveled edges will face the steel balls.





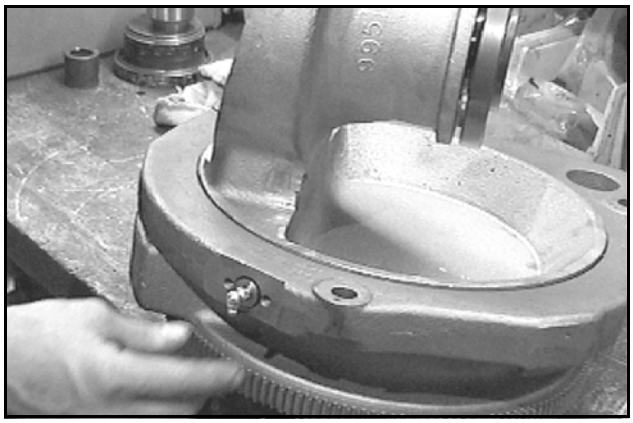
2. Install the pivot ring assembly to the gear case. The spherical bearing should face the spur gear.



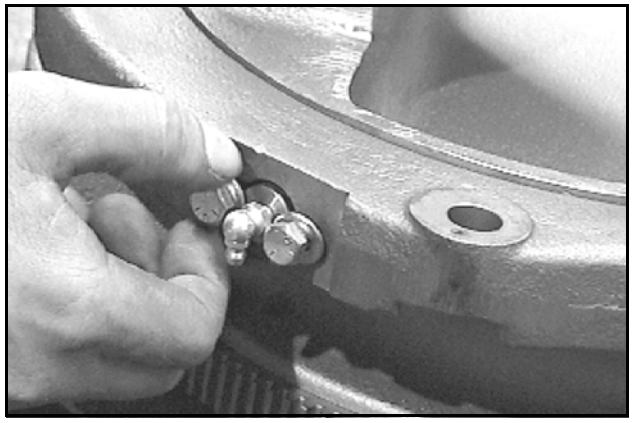
3. Place one steel ball (26) at a time into the pivot ring (27) filler hole. Use a screwdriver to direct the steel balls first to one side then the other.

NOTE!	Be sure to count the steel balls as inserted in the pivot ring assembly for proper pivot ring operation. Drive unit requires 65 balls. Too many balls will cause binding and too few balls will cause excessive motion.

4. Continue until all the steel balls are installed.



5. Place the bearing filler plug (28) in the filler hole. The grease fitting (30) should face the spur gear.

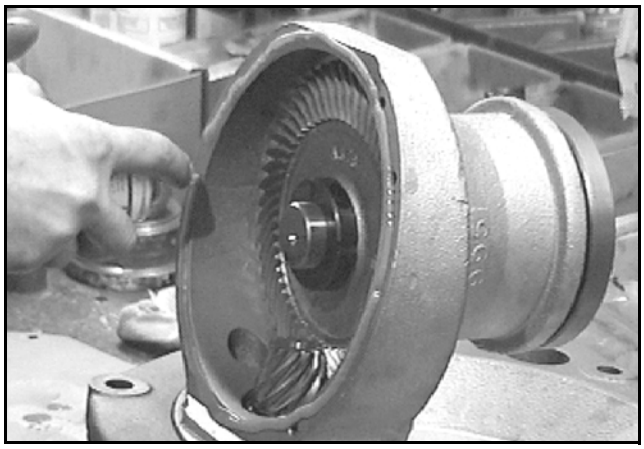


⚠ CAUTION Excessive thread locking compound will damage the ball bearings and pivot ring. Use thread locking compound sparingly.

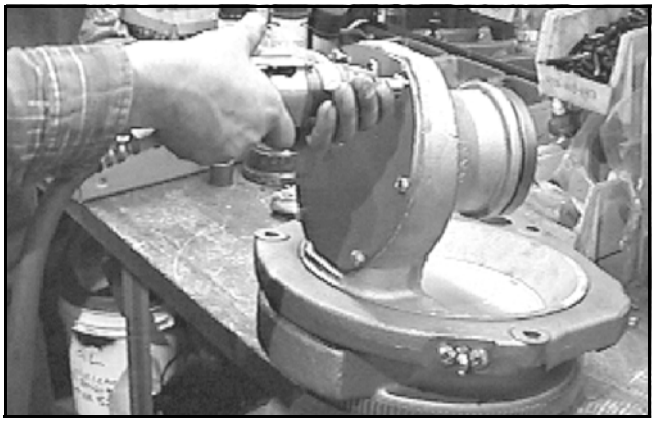
6. Apply Loctite 242® sparingly to the filler plug bolts (31). Install the bolts on each side of the grease fitting (30). Tighten to 20 ft-lbs (27 N•m).
7. Grease and test the pivot ring to make sure it spins freely.

4.2.9. Gear Case Cover

Installation



1. Clean the cover mating surface. Apply Loctite 587® to the surface where the cover (12) contacts the gear case (2).



2. Install the cover bolts (11) and torque to 20 ft-lbs (27 N•m).

NOTE!	Use cover mounting bolts to mount the cover.

3. Apply thread locking compound to the drain plug (14). Install the drain plug in the cover plate and torque to 15 ft-lbs (20 N•m).